DOCUMENT RESUME

ED 279 301 IR 012 540

AUTHOR Ely, Donald P.
TITLE Educational Technology Research: A Status Report on Classroom Applications.
PUB DATE 24 Oct 86
NOTE 14p.; Paper presented at EDUTEC '86, the All Japan Annual Educational Technology Research Conference (12th, Tokyo, Japan, October 25-27, 1986).
PUB TYPE Viewpoints (120) -- Reports - Descriptive (141) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Educational Media; *Educational Technology; Evaluation Criteria; Instructional Development; *Media Research; Research Utilization

ABSTRACT

Pointing out that most educational research conducted is related to development (i.e., practical answers to problems which face teachers and learners), this paper reviews the contributions of educational media and technology research as it applies to instruction and assesses the current status of research in this area. Earlier interpretations and popular misconceptions of the role of educational technology are reviewed, five distinct periods of educational media and technology research are identified, and the following questions associated with each period are discussed: (1) whether it works; (2) how well it works; (3) the conditions under which it works; (4) the types of learners it works with; and (5) the conditions under which different types of learners achieve various objectives, which seems to be the current research focus. Changing emphases in educational media and technology research are noted, as well as the importance of asking the "right" research questions. Criteria for determining the potential utility of research findings are summarized and findings of prior research that are generalizable to the design and development of instruction are highlighted. A list of some specific areas where research is needed and a look at some trends that may build on those that are currently developing within the field conclude the paper. A 19-item bibliography is provided. (DJR)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED279301

CENTER (ERIC)
This document has been reproduced as received from the person or organization originating it.
Minor changes have been made to improve reproduction quality.
Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Donald P. Ely
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

EDUCATIONAL TECHNOLOGY RESEARCH: A STATUS REPORT ON CLASSROOM APPLICATIONS

Donald P. Ely, Professor, Instructional Design, Development and Evaluation, and Director, ERIC Clearinghouse on Information Resources, Syracuse University, Syracuse, NY, U.S.A.

The word, "research", means many things to many people. To a scientist it means a studious inquiry into an unknown subject; to a journalist it means an investigation into a "story" which requires further information before the complete story can be told; to a marketing manager it means the study of the potential reactions of a target population to a new product; and to an educational technologist it means a systematic approach to answering questions about teaching and learning.

In many industries, the word, "research" is combined with "development" which means that there is a concern for application of information to the creation or alteration of a product or process. In education, most of our research is related to development. Educators are aware of theory (and even use it sometimes) but more often, we seek to find answers to practical problems which face teachers and learners. It is in the area of educational research and development that studies attempt to explore current instructional problems and new approaches to the solution of those problems.

The Purpose of this Paper

If we want to use educational technology to its fullest potential, we must study the role of the teacher, the role of the media, the role of the learner, and the environment in which they all interact. Innovations must be considered within the historical and cultural context in which they occur. This paper will attempt to review the contributions of educational

IR012540

BEST COPY AVAILABLE

media and technology research as it applies to instruction and to assess the current status of research in this area. These conclusions about what we already know will lead to some recommendations for future research.

Background: The Role of Media and Technology

There have been a series of definitions for the field of educational technology in the past fifty years (Ely, 1983) but none of them clarified the role of educational media and technology. One impression of media and technology is that it is an "aid" or enhancement of the teaching process. The teacher uses an overhead projector, a slide/tape, a videotape or a microcomputer as an adjunct to instruction. It has always been felt that a teacher with media is better than a teacher alone. Schramm (1977, p. 267) says in his summary of media research: "Students learn from any medium, in school or out, whether they intend to or not,...providing that the content of the medium leads them to pay attention to it." Most of the early research compared the traditional teacher with an instructional medium and most of the studies revealed "no significant differences."

A second interpretation of the role of media and technology, and a more contemporary one, is that of replacement. An instructional medium can perform certain teaching functions without the physical presence of the teacher. Replacement means that certain teaching procedures can be handled by media. For example, a microcomputer can provide an interactive opportunity in learning basic mathematical principles; a videotape can illustrate a laboratory demonstration in a clear and correct fashion; and thousands of distance learners can learn from media and technology without the physical presence of the teacher. The first and most fundamental conclusion from the research is that all media can instruct and learners can learn from

almost any medium (Chu and Schramm, 1967; Jamison, Suppes, & Wells, 1974).

Some Misconceptions

Before we explore some of the specific research studies, we should acknowledge some of the popular misconceptions regarding the role of media and technology in education.

1. Media Equals Educational Technology. Media are the products used within an instructional system. Educational technology is a complex organization of many elements which are designed to help bring about changes in the behavior of learners. Media are part of the system (Ely, 1983). The popular term is "delivery system." Media deliver information in many forms and configurations.

2. The use of media will automatically bring about learning. Most research indicates that the way media are used will determine the learning outcomes. After an extensive review of the research, Schramm (1977, p. 267) concludes that "a teacher can feel a great deal of confidence that motivated students will learn from any medium if it is competently used and adapted to their needs."

3. One medium is superior to another. There is absolutely no research to substantiate this contention. We may prefer one medium to another, or one medium may be easier to use or more widely available, but that does not mean that it is the best medium. We are beginning to conclude that it is the design of the software that can bring about consistently replicable quality instruction rather than the medium used (Gerlach, 1984, p. 27). Today we talk about the software (the subject matter, the content, the structure) rather than the medium.

4. A new medium will solve problems that have not been solved before. We

always seem to be searching for the perfect medium; the learning system which will guarantee learning; and it always seems to be "just around the corner." We already have sufficient media and technology to do all that we need to do for teaching and learning. Perhaps we should shift our attention to questions of cost effectiveness and conditions of use (Sakamoto, 1981).

5. Research findings justify the use of media and technology. We all feel better when our work is supported by research findings. We feel more secure when we know that our products "work." Some people have learned how to manipulate statistical results so that findings favor the position they advocate. It is not necessary to go too far to find research results which can help our cause. However, it is dangerous to distort the interpretations of research data. Research findings alone are insufficient to make a case for the use of media and educational technology procedures. We should begin with problems to be solved and acknowledge the many variables which must be considered in finding solutions; the appropriate use of media and technology may be one of them (Salomon, 1978).

Research Through the Years

There seem to be five distinct periods of educational media and technology research. Each period was marked by a dominant question. Each period led to the next and usually built upon its predecessors. Let us consider each period and the research questions which are being investigated.

Phase One. The research question was: DOES IT WORK? Can the students learn from a particular medium (e.g., motion pictures, radio, television, etc.)? How does medium A compare with medium B in terms of student learning and retention?

Phase Two. The research question was: HOW WELL? Are there certain physical

and technical designs of the materials themselves which will facilitate learning? Can learning be increased by changing certain variables? For example, are there differences between color and black & white images in terms of learning and retention? Does angle of viewing a motor task facilitate or hinder the learning of that task (Hoban and VanOrmer, 1951)?

Phase Three. The research question was: UNDER WHAT CONDITIONS? What is the instructor's role in using the media? What conditions facilitate the use of media? For example, what will be the effect of questions raised prior to a motion picture film showing? To what extent will repeated showings of a film increase learning and retention?

Phase Four. The research question was: WITH WHAT TYPE OF LEARNERS? What are the relationships of student ability and the instructional treatment? (This research was called aptitude-treatment interaction). The complexity of instructional treatment and the learners were considered to be dominant variables. For example, what are the learning differences among high, medium, and low ability students on acquisition of a cognitive concept (Allen, 1975)?

Phase Five. This is the present time when the research question seems to be: "Under X conditions (which include the use of media), does Y type of learner achieve Z objectives?" The simple questions regarding media variables have given way to a more sophisticated search of the multiple factors that affect learning. The current research has a flavor of evaluation and in-depth case studies using descriptive methods seem to be favored over controlled experiments. Gerlach's analysis (1984) indicates that "there is a tendency to decrease the emphasis on numerical data (p. 25)."

We are living through a unique time as research emphasis in educational media and technology are changing. During a time of change we must keep one

one foot in the past and one foot in the future. We must ask: "What has the past taught us?" And we should look ahead and ask: "What opportunities might the future offer?" These two guides can support and help us to ask the "right" research questions. Let us explore each era as we aim toward a research agenda for the future.

Looking Backward

We should know that research findings have already been reported. One of the most efficient ways of reviewing past research is by reading well-written research summaries. When we use such summaries, there are criteria which can help us to determine their potential utility.

o Are the findings based on comprehensive and consistent data over time? There is much to recommend the meta analysis method of Glass, McGaw, and Smith (1981) as applied by Kulick, Bangert, and William (1983) and the syntheses of Jamison, Suppes, & Wells (1974).

o Are the analyses done by people with solid research reputations? The element of trust is essential if you are unsure of the quality of the individual research studies reviewed. Wilbur Schramm (1967; 1977) is one such person; Gavriel Salomon (1978) is another.

o Are the results based on cross-cultural sources? Many professionals tend to be parochial when it comes to research. They seek out studies done in their own country and either neglect international sources or use one country findings to generalize across several nations. One of the best sources of cross-cultural educational research are the studies of the International Association for the Evaluation of Educational Achievement (Rosier, 1983) which uses multinational settings and longitudinal procedures in its investigation.

What We Know

Research has uncovered many useful findings. In this section we will highlight those findings that seem to be generalizable to the design and development of instruction. If some findings are not reported, it does not mean that they are unimportant. They may not be generalizable or may have been overlooked. We should be able to proceed with the conclusions which follow.

1. Most instructional tasks can be performed by most media (Gagne, 1965, p. 364).

2. How a medium is used may be more important than the choice of a medium. Learning seems to be affected more by what is delivered than by the delivery system (Schramm, 1977, p. 273).

3. When media are selected and produced, taking into account both media attributes and student characteristics, and systematically integrated into the instructional program, they have a significant impact on student achievement and self image (Wilkinson, 1980, p. 39).

4. The basic psychological principles of requiring an active, overt response and immediate feedback to the learner is the single most important design feature.

5. There is a strong positive relationship between intelligence and learning (Clark, 1983).

These generalizations are useful guidelines to assist instructional developers in the design of products and strategies to facilitate learning. There are corollaries to these findings and many more specific prescriptive guidelines exist (Fleming and Levie, 1978; Merrill and Tennyson, 1977) that are beyond the scope of this paper. The point is that we know enough to design

and develop instruction that works with defined groups of learners; we do not use all that we know and often we do what feels right rather than follow the valid rules which have been generated by over 40 years of research.

What We Do Not Know

There always seems to be more questions than answers. Research is the process of finding answers, or clues to answers. Sometimes we cannot wait. We must move ahead before we have all the answers. Much of our work in educational technology is driven by the need to produce materials and to recommend teaching and learning strategies without all of the guidance we would like to have. So we use what we know, try to make sound judgements about what we do not know and evaluate the results. It is in this process of evaluation that we often do our research.

Some of the questions which should be explored are in the area of message design--the graphic and verbal configurations which serve as stimuli for the learner, e.g., screen design for CAI; some questions focus on use--the conditions that facilitate the learner's attainment of objectives, e.g., the structure of the stimulus material and the speed of feedback; and some questions revolve around the process of change, e.g., to what extent does teacher control of media facilitate or hinder acceptance of an innovative procedure?

Some researchers have identified some specific areas for research within the field.

1. What techniques promote the transfer of learning from the training environment to the application setting (Clark, 1983)?

2. What are the maps of mental processes and how can these cognitive models interface with behavioral technology to create prescriptions for instruc-

tional strategies and media (Clark, 1983)?

3. Why have most educational technologies not gained wide adoption (Hatvia, 1986)?

4. Can savings of time be shown over long periods and for a large amount of total instructional program (Jamison, Suppes, and Wells, 1974)?

5. What is the impact of media use on learner motivation (Jamison, Suppes, and Wells, 1974)?

6. Are there procedures which can incorporate social, political, and cultural variables into the research designs (Salomon, 1978)?

7. What prescriptive instructional principles can be verified and established (Winn, 1986)?

8. Does following a design or development model lead to superior instruction (Winn, 1986)?

9. What are the relationships between instructional prescriptions and learner control? Are the predetermined prescriptions facilitative or hindering to the learner (Winn, 1986)?

This list is only suggestive of many questions that have been and will continue to be raised.

Looking Forward

Research will continue because man is curious but it will be scattered and much of it will be unrelated because there is no unifying theory upon which to build a comprehensive research program. I believe that the following trends will build upon those that are currently developing.

1. Much more emphasis will be placed on the individual learner with allowances made for the differences among learners. For the first time in human history we have the tools which permit individualization of instruction. We will study the process and create rules and principles which will help us to design specific materials for specific needs.

2. The research will focus on the cognitive processes of learning rather than the structure of teaching. More emphasis will be placed on innovative and creative conditions of learning that move away from the traditional instruction protocols with one teacher standing before a group of students. The use of simulations, databases, and experiental resources will lead to new studies of how people learn and how to arrange the contingencies of learning for maximum comprehension and retention.

3. There will be a gradual blurring of research and evaluation activities. More qualitative data gathering and analysis will help to reveal the complex forces which impinge upon the learning process. The case study will become the basis of heuristics which will become the hypotheses of more controlled studies. Prototype models will serve as generalizations to be imitated and modified as feedback data help to make adjustments based on learner's responses.

4. More cross cultural research will be done and the results will be tested across several countries. Transfer of technology studies will consider cultural variables which can affect the results of inquiries. Such research will reveal variables that must remain constant from culture to culture and those which can be allowed to be flexible.

Finally, we must never lose sight of the need for research. It may not tell us all that we need to know; it may give us general guidelines to use; it may seem esoteric at times. Yet, even with these limitations, it is the use of research which distinguishes the technician from the professional. The

technician know how to operate in a technological environment; the professional not only knows how but also why and that knowledge comes mostly from research. Seek out that knowledge and you will become a better professional.

BIBLIOGRAPHY

Allen, W.H. (1975) Intellectual Abilities and Instructional Media Design. AV Communication Review. 23:2, 139-170.

Chu, G. and Schramm, W. (1967) Learning From Television: What the Research Says. Stanford, CA: Institute for Communication Research.

Clark, R.E. (1983) The Next Decade of Instructional Technology Research. Educational Considerations X:2, 33-35.

Ely, D.P. (1983) The Definition of Educational Technology: An Emerging Stability. Educational Considerations X:2, 2-4.

Fleming, M. and Levie, W.H. (1978) Instructional Message Design: Principles From the Behavioral Sciences. Englewood Cliffs, NJ: Educational Technology Publications.

Gagne, R. (1965) The Conditions of Learning. New York: Holt, Rinehart & Winston.

Gerlach, V.S. (1983) Trends in Instructional Technology Research, in Brown, J.W. (ed.) Trends in Instructional Technology. Syracuse, NY: Information Resources Publications.

Glass, G.V., McGaw, B., and Smith, M.L. (1981) Meta-Analysis in Social Research. Beverly Hills, CA: Sage Publications.

Hatvia, N. (1986) Computer Guided Teaching: The Microcomputer Revolution. Journal of Educational Computing Research. 2:3, 307-324.

Hoban, C.F. Jr. and Van Ormer, E.B. (1950) Instructional Film Research 1918-1950. Port Washington, NY: U.S. Navy Special Devices Center.

Jamison, D., Suppes, P. and Wells, S. (1974) The Effectiveness of Alternative Instructional Media: A Survey. Review of Educational Research. 44:1, 1-67.

Kulick, J.A., Bangert, R.L., and Williams, G.W. (1983) Effects of Computer-Based Teaching in Secondary School Science. Journal of Educational Psychology. 71:1, 19-26.

Merrill, M.D. and Tennyson, R.D. (1977) Teaching Concepts: An Instructional Design Guide. Englewood Cliffs, NJ: Educational Technology Publications.

Rosier, M.J. (1983) IEA: Activities, Institutions and People. Oxford: Pergamon Press.

Sakamoto, T. (1981) Can Mass Media Be Effective in Curriculum Improvement? The Educational Use of Mass Media. Washington, DC: The World Bank. Staff Working Paper No. 491, 45-52.

Salomon, G. (1978) On the Future of Media Research. Educational Communications and Technology Journal. 26:1, 37-46.

Schramm, W. (1977) Big Media, Little Media. Beverly Hills, CA: Sage Publications.

Wilkinson, G.L. (1980) Media in Instruction: 60 Years of Research. Washington, DC: Association for Educational Communications and Technology.

Winn, W. (1986) Emerging Trends in Educational Technology Research, in Proceedings of Selected Research Papers Presented at the 1986 Annual Convention of the Association for Educational Communications and Technology. Ames, IA: Instructional Resources Center, College of Education, Iowa State University.